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MONTHLY  
MICROCLIMATIC SUMMARY

APRIL 1967

ENVIRONMENTAL DATA BASE  
FOR REGIONAL STUDIES IN THE HUMID TROPICS

USATECOM Project No. 9-4-0013-01

US ARMY  
TROPIC TEST CENTER  
Fort Clayton, Canal Zone

Sponsored by

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ENVIRONMENTAL DATA BASE  
FOR REGIONAL STUDIES IN THE HUMID TROPICS

MONTHLY  
MICROCLIMATIC SUMMARY

APRIL 1967

Prepared by

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and  
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USATECOM Project No. 9-4-0013-01

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## MONTHLY MICROCLIMATIC SUMMARY

### Introduction

Monthly microclimatic data summarized in this series of reports were collected by the US Army Tropic Test Center and the Weather Engineers of Panama Corporation under the project, Environmental Data Base for Regional Studies in the Humid Tropics. The project is sponsored by the Advanced Research Projects Agency of the Department of Defense and by the Army Research Office, Office of the Chief of Research and Development. It is an investigation of microclimatic, air chemistry, vegetation, soils, microbiological, and macrofaunal conditions at selected sites in the principal tropical environments of the Panama Canal Zone and the Rio Hato Military Reservation. The objective of the project is to assemble quantitative environmental data for RDT&E purposes.

Sites. Data summarized in this report were collected at the Albrook Forest and Chiva Chiva sites. Figure 1 shows the site locations within the Isthmus of Panama. Geographic coordinates are shown below:

Albrook Forest	09° 01'N, 79° 33'W
Chiva Chiva	09° 01'N, 79° 35'W
Fort Kobbe (satellite)	08° 54'N, 79° 34'W
Fort Sherman (satellite)	09° 16'N, 79° 59'W
Albrook (satellite)	09 00'N, 79° 33'W

The Chiva Chiva open site and the Albrook Forest site are paired for comparative study of environmental conditions in a tropical semideciduous forest and in a large clearing. Both are located in a region where the annual precipitation is approximately 80 inches and there is a pronounced dry season. The other satellite sites were located primarily for soil studies purposes. Albrook and Fort Kobbe have climatic regimes similar to the principal sites.

The Albrook and Chiva Chiva main sites are approximately four kilometers apart. Each has a 46-meter walk-up tower and an air-conditioned building to house the recording equipment and observers. Both sites are approximately 30 meters above sea level. The top of the forest canopy at the Albrook site is about 26.5 meters above the ground.

Instrumentation. A wide range of climatic elements are measured at the Albrook and Chiva Chiva sites. Types of observations and frequencies are shown on Figure 2. The towers at the Albrook and Chiva Chiva sites are similarly oriented. Sensing equipment is mounted at several levels on the towers to provide measurements through the vertical profile. Additional instruments are emplaced in the immediate vicinity on or near the ground.

All instrument exposures are duplicated at each site. Figures 3, 4, and 5 show the instrument array at these sites.

Data Reduction and Storage. All data, as applicable, are recorded at or reduced to each full hour and transposed to punch cards. These punch cards, together with all raw data, are stored in the Tropic Test Center Technical Library Annex.

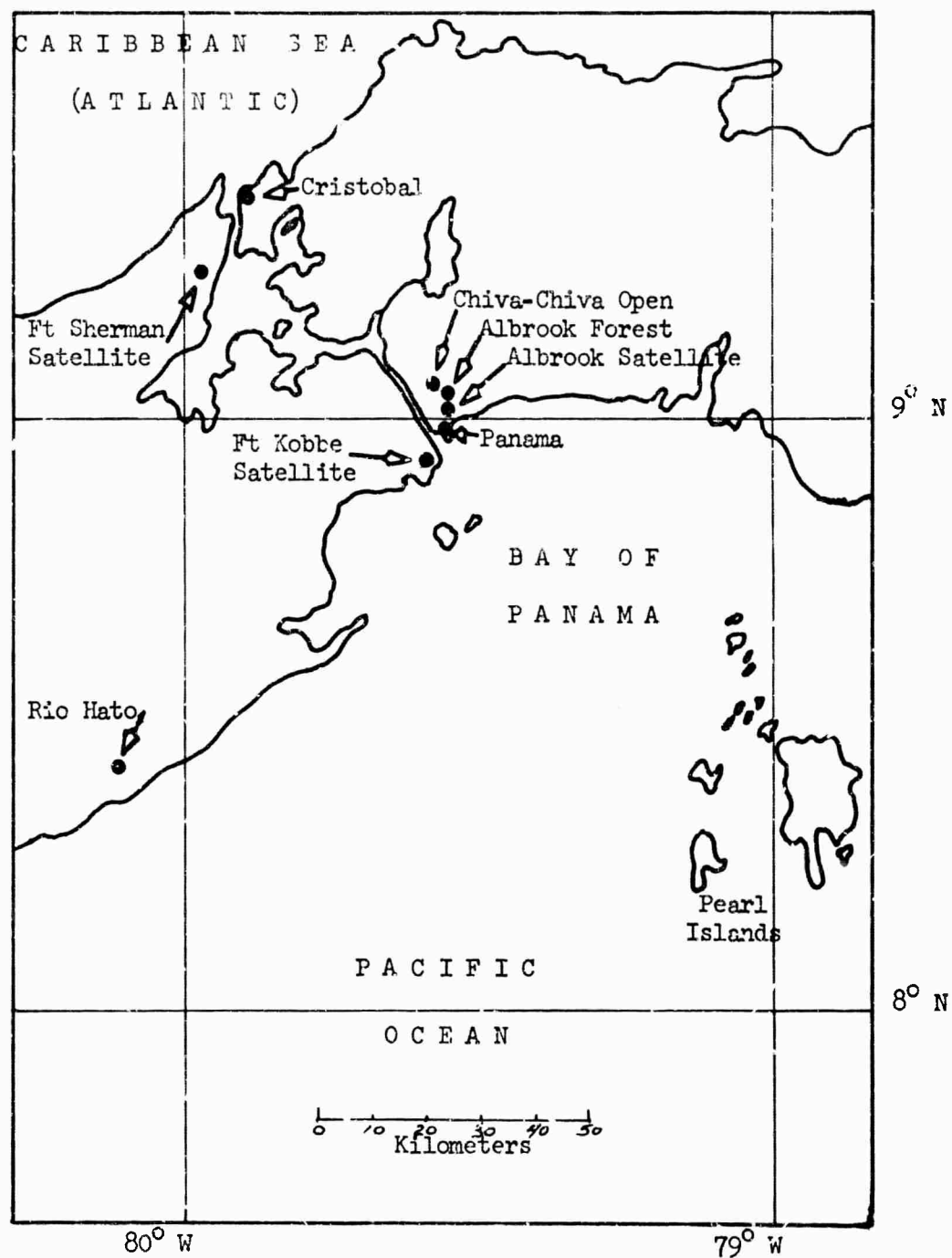


FIGURE 1.

LOCATION MAP, ISTHMUS OF PANAMA

FIGURE 2. FREQUENCY OF OBSERVATIONS

# Element	Stg	Height (meters)						Frequency	
		0.5	1.0	2.0	4.0	8.0	13.5		
Temperature:									
Dry Bulb	2	2	1	2	2	2	2	2	Hourly*/Continuously
Wet Bulb	1	2	-	2	2	-	-	-	Hourly*/Continuously
Glass Minimum	1	-	-	-	-	-	-	-	Once Daily
WBGT Index	-	-	2	-	-	-	-	-	Hourly(0600-1500 EST)
Relative Humidity	-	2	1	2	2	2	2	2	Hourly*/Continuously
Barometric Pressure	-	-	2	-	-	-	-	-	Continuously
Evaporation	2	-	-	-	-	-	-	3	Once Daily
Precipitation:									
Recording Gage	-	-	1	-	-	-	-	-	Continuously
Manual Gage	-	-	3	-	-	-	-	-	4 Times Daily
Stem Flow	-	-	3	-	-	-	-	-	4 Times Daily
Wind:									
Direction	-	-	-	-	5	-	-	-	Continuously
Speed	-	-	-	2**	5	2**	2**	2**	Hourly**/Continuously

1. All sites  
2. Albrook and Chiva Chiva  
3. Albrook only  
4. Chiva Chiva only  
5. Main sites

\* Observation made with sling psychrometer when recorders are inoperative.  
\*\* Hourly.  
# Instrument descriptions are contained in the Environmental Data Base semiannual reports.

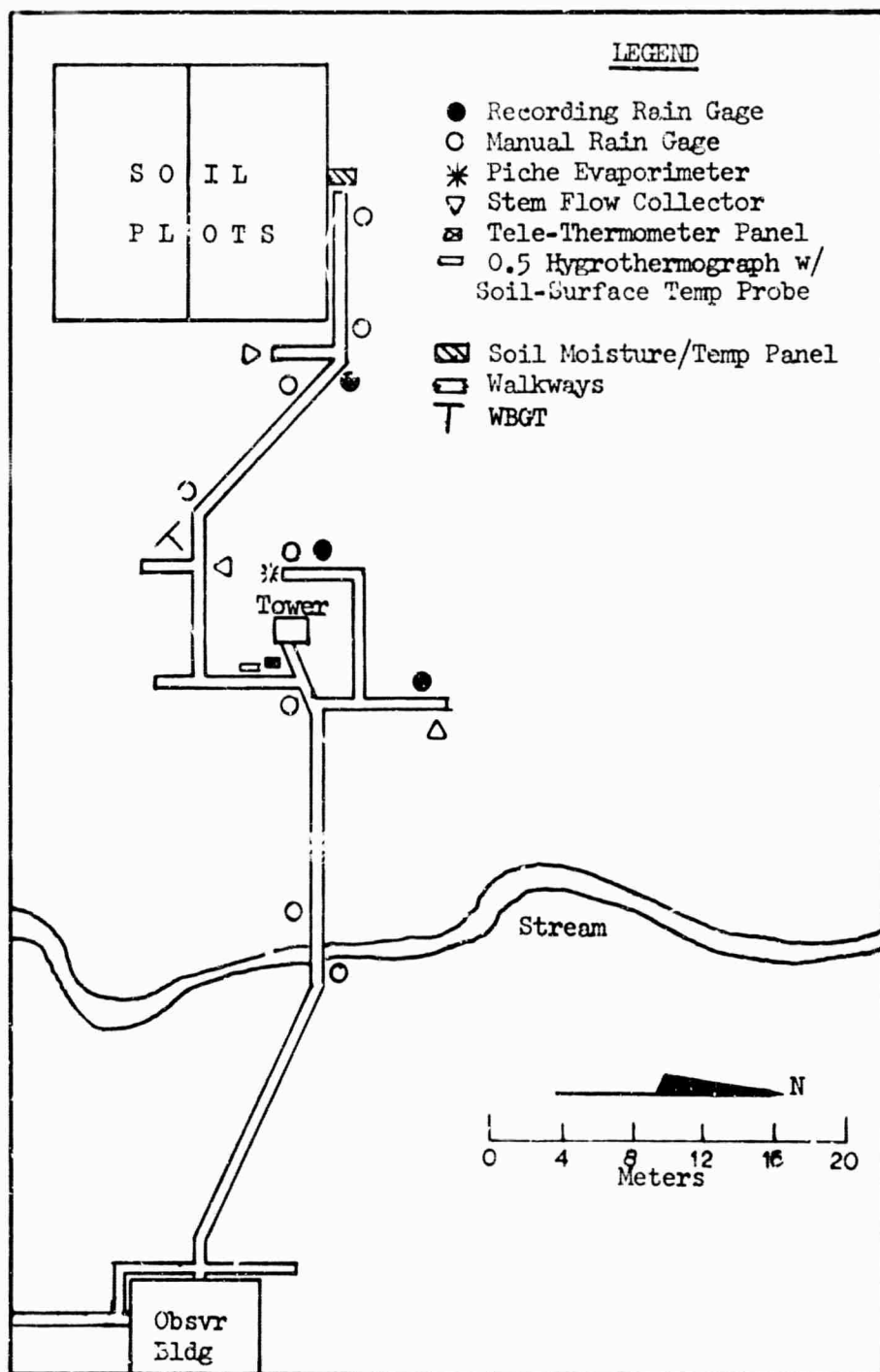


FIGURE 3.

ALBROOK FOREST SITE, GENERALIZED PLOT

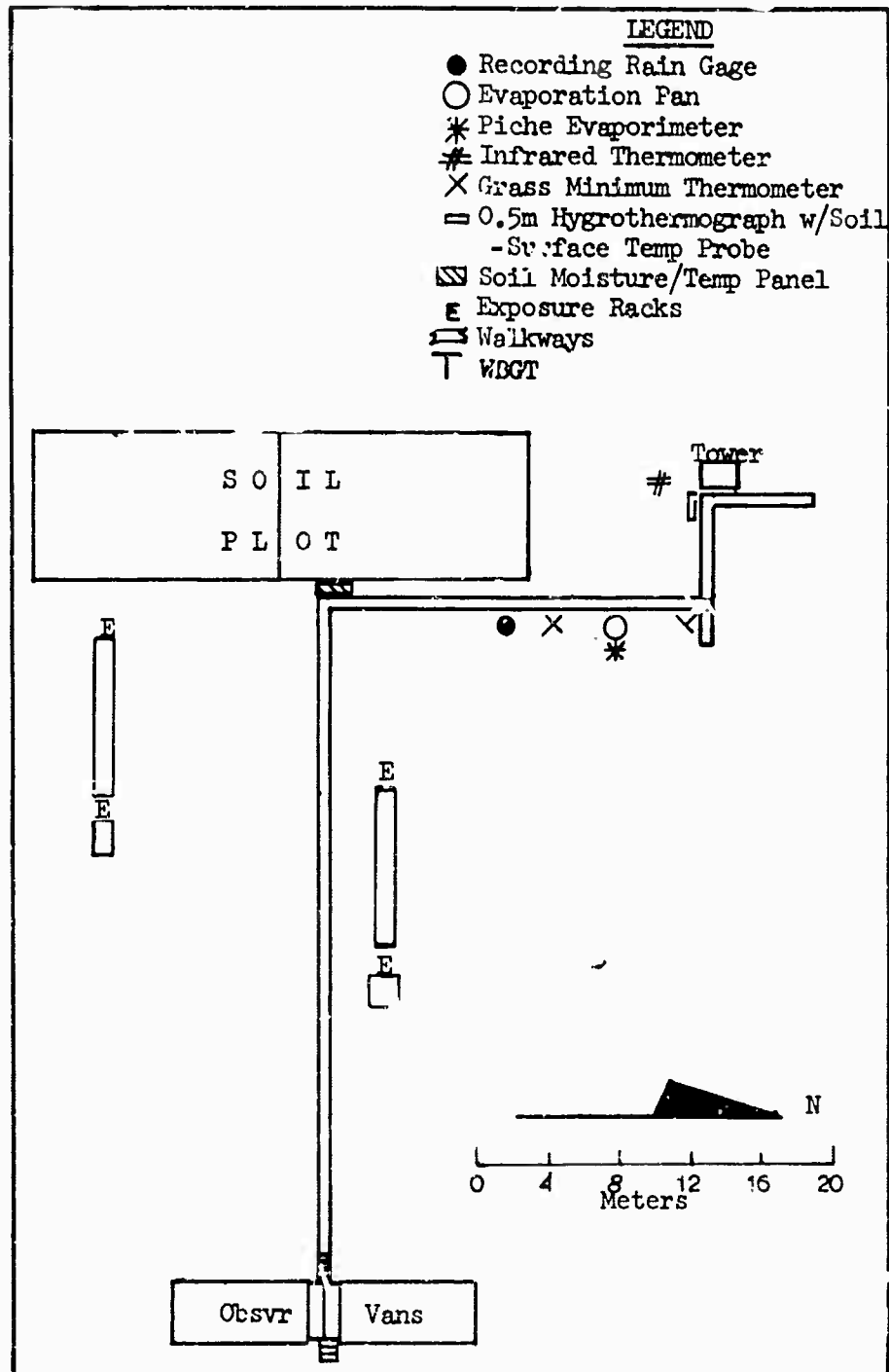


FIGURE 4.

CHIVA CHIVA OPEN, GENERALIZED PLOT

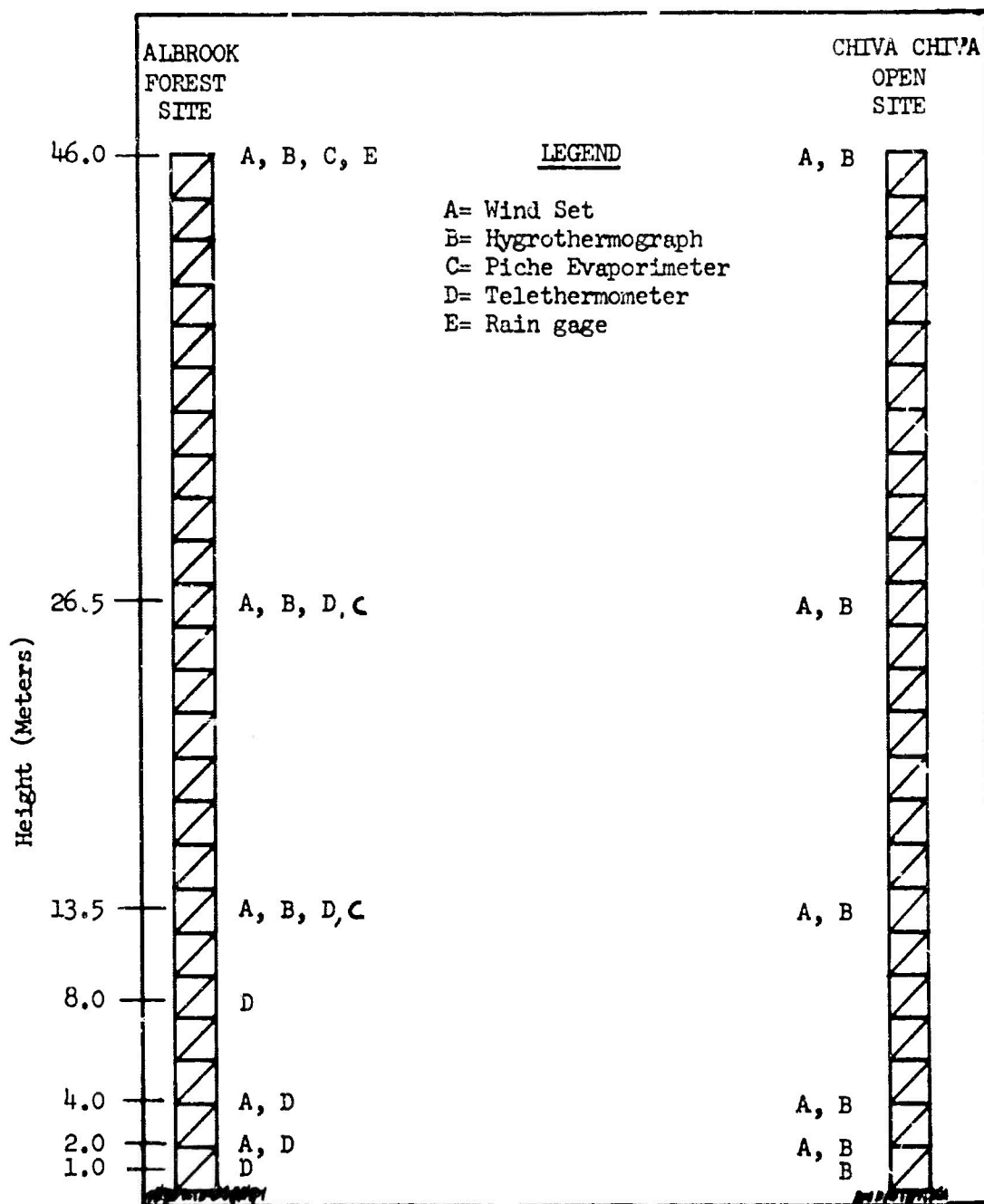


FIGURE 5.  
INSTRUMENT LOCATION ON TOWERS

# SUMMARY OF METEOROLOGICAL OBSERVATIONS HOURLY DATA APRIL 1967

Exposure		Monthly Means of Air Temperature by Hour (°C F)																								Monthly Summary			
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No. of Obs.	Min.	Mean	Max.
Albrook (Forest site)	46.0 m	75.6	75.3	75.1	74.7	74.6	74.5	75.8	78.6	82.4	84.7	84.8	85.3	85.9	85.1	84.0	83.3	81.6	79.6	78.1	77.5	77.0	76.6	76.3	76.0	677	70.1	79.0	91.4
	28.5 m	This level was not instrumented for air temperature at this time																											
	26.5 m	74.9	74.7	74.3	74.1	73.8	73.8	75.6	78.7	82.9	84.9	85.2	85.8	86.3	85.8	84.4	83.5	81.9	79.7	77.5	76.9	76.3	75.9	75.5	75.2	715	69.0	79.0	92.0
	13.5 m	74.6	74.4	74.2	73.8	73.5	73.3	74.0	76.6	79.9	82.2	83.4	84.1	84.3	84.5	83.0	82.3	81.7	79.7	78.0	77.0	76.5	75.9	75.5	75.0	719	68.2	78.2	91.9
	8.0 m	74.4	74.3	74.0	73.6	73.3	73.1	73.9	77.0	80.0	82.5	83.6	84.0	84.5	84.0	82.7	82.3	80.9	79.1	77.7	76.7	76.1	75.6	75.1	74.7	716	68.1	78.0	92.6
	4.0 m	74.0	73.7	73.5	73.2	72.8	72.6	73.9	77.2	80.1	82.4	83.2	84.2	84.8	84.2	82.5	82.8	80.9	79.0	77.4	76.4	75.8	75.2	74.7	74.3	704	67.2	77.8	92.4
	2.0 m	73.9	73.6	73.5	73.1	72.9	72.6	73.8	77.0	79.7	82.2	83.2	84.4	84.8	84.3	82.5	82.5	80.9	79.0	77.3	76.4	75.7	75.2	74.6	74.2	706	67.2	77.8	92.7
	1.0 m	74.3	74.2	73.9	73.7	73.4	72.6	73.6	77.0	79.8	82.6	83.7	84.3	85.1	84.5	82.2	82.4	81.1	79.2	77.4	76.8	76.0	75.5	75.0	74.6	697	68.2	77.9	92.5
0.5 m	74.4	74.3	74.0	73.7	73.5	73.0	73.7	76.6	79.3	81.6	83.5	84.7	85.0	84.6	82.9	82.7	81.1	79.5	77.8	76.8	76.3	75.6	75.1	74.6	720	67.7	78.1	93.3	

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Chiva Chiva (Open site)	46.0 m	75.8	75.7	75.3	75.2	75.0	74.8	76.3	79.3	81.9	83.4	84.3	85.2	84.7	84.5	83.7	82.9	81.3	79.9	78.6	78.0	77.3	76.9	76.6	76.1	712	70.7	79.2	89.8										
	28.5 m							This level was not instrumented for air temperature at this time																															
	26.5 m	75.8	75.6	75.2	75.0	74.6	74.6	76.0	78.9	81.7	83.3	84.3	85.3	84.9	84.8	84.2	83.4	81.6	80.4	79.0	78.3	77.6	77.1	76.7	76.3	720	70.0	79.4	90.3										
	13.5 m	75.5	75.2	75.0	74.8	74.4	74.3	75.8	78.7	81.9	83.5	84.5	85.5	85.1	85.0	84.3	83.5	81.6	80.4	78.8	78.1	77.4	77.0	76.4	76.0	720	69.1	79.3	90.2										
	8.0 m							This level was not instrumented for air temperature at this time																															
	4.0 m	75.2	74.9	74.5	74.1	73.9	73.7	76.0	80.2	83.3	85.3	86.5	87.0	86.6	86.5	86.5	85.4	82.6	80.7	79.0	78.1	77.5	76.7	76.1	75.6	716	68.1	79.8	93.9										
	2.0 m	75.0	74.7	74.3	73.9	73.7	73.5	76.0	80.4	83.4	85.5	86.6	87.2	86.6	86.7	86.6	85.6	82.6	80.6	78.7	77.9	77.1	76.4	75.8	75.4	716	67.7	79.7	93.7										
	1.0 m	74.8	74.6	74.2	74.0	73.6	73.4	76.6	81.8	84.5	87.3	88.8	88.9	88.2	88.1	87.2	86.1	83.1	80.8	78.9	77.9	76.9	76.3	75.8	75.3	712	67.5	80.2	97.0										
	0.5 m	74.9	74.8	74.4	74.1	73.7	73.6	75.4	80.1	83.3	86.3	88.0	89.1	88.0	87.6	86.9	85.5	82.8	80.5	78.4	77.5	76.7	76.1	75.6	75.2	719	68.6	77.9	97.5										



# SUMMARY OF METEOROLOGICAL OBSERVATIONS

## HOURLY DATA

APRIL 1967

Exposure	Site	Monthly Ranges of Air Temperature by Hour (° F)																								Monthly Summary*
		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albrook (Forest site)	46.0 m	6.6	6.9	7.1	7.6	7.9	8.0	6.7	DTF	DTF	DTF	DTF	DTF	DTF	16.6	15.2	17.8	13.4	9.7	8.2	6.1	5.8	6.3	6.5	6.8	
	28.5 m								This level was not instrumented for air temperature at this time																	
	26.5 m	8.3	7.5	8.0	8.2	9.5	8.4	8.8	9.0	12.6	14.1	13.5	13.4	15.5	18.0	17.7	17.0	16.4	11.5	6.4	6.9	7.9	8.3	8.3	8.4	
	13.5 m	7.0	7.0	7.4	7.7	8.2	8.7	8.7	7.5	10.2	12.4	13.1	13.6	15.3	17.0	15.0	16.0	14.7	10.4	7.9	7.0	6.9	7.2	7.3	7.1	
	8.0 m	7.1	7.2	7.9	8.5	8.4	9.5	8.6	7.2	10.6	14.7	13.2	13.8	15.1	18.5	16.8	16.3	13.3	10.8	8.8	6.8	7.5	6.6	6.2	7.4	
	4.0 m	6.8	7.7	8.7	8.9	8.8	10.1	8.9	8.0	10.5	12.4	13.4	12.9	16.5	18.6	16.6	17.6	13.6	10.7	8.4	7.6	7.8	7.5	6.2	7.0	
	2.0 m	6.8	7.2	8.5	8.8	8.6	9.8	8.9	7.7	10.4	13.3	12.9	12.7	16.0	18.3	16.5	17.5	13.7	10.7	8.4	7.6	7.7	7.3	6.4	6.8	
	1.0 m	6.7	7.3	7.3	8.0	8.2	8.5	8.8	7.6	10.7	13.8	13.9	15.0	16.8	17.5	17.1	15.7	14.2	11.0	8.8	7.0	7.1	6.7	6.4	5.8	
	0.5 m	7.4	7.9	7.7	7.6	8.9	9.0	8.9	7.9	10.3	14.0	13.3	14.7	15.6	18.4	16.4	16.9	13.4	10.1	8.2	8.2	7.7	7.0	6.3	6.1	

\* No monthly summary was computed for the ranges.

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Chiva Chiva (Open site)	46.0 m	6.1	6.3	6.1	6.4	6.8	6.7	6.9	8.5	11.2	12.5	14.4	14.1	15.9	15.7	15.0	15.5	12.3	9.3	6.9	5.8	6.5	6.9	6.6	5.9	
	28.5 m								This level was not instrumented for air temperature at this time																	
	26.5 m	7.5	8.0	8.2	7.6	7.8	7.3	6.8	8.8	11.7	12.1	14.0	13.4	16.4	15.1	15.0	15.6	12.6	10.2	7.9	6.4	6.7	7.7	6.9	7.0	
	13.5 m	7.6	7.6	7.8	7.8	8.4	8.6	6.9	8.0	10.8	12.2	14.0	13.8	16.0	15.9	15.1	17.5	13.4	10.8	7.4	7.6	6.7	7.1	7.5	7.3	
	8.0 m								This level was not instrumented for air temperature at this time																	
	4.0 m	8.1	8.6	9.4	9.4	9.6	9.8	8.7	9.8	13.1	12.7	15.8	15.8	17.6	19.7	16.5	15.6	14.9	9.4	7.1	5.8	7.0	7.4	7.6	8.3	
	2.0 m	7.8	8.2	8.9	9.1	9.2	10.5	7.9	9.7	12.9	13.2	15.7	15.9	18.2	19.2	16.6	16.1	14.7	9.7	7.0	5.6	6.5	6.6	7.2	7.5	
	1.0 m	8.4	8.7	9.7	9.5	10.0	10.0	8.7	11.8	15.1	13.7	19.0	19.2	19.8	22.2	20.0	20.6	17.4	10.3	7.7	7.1	6.5	7.5	8.0	7.6	
	0.5 m	6.7	6.5	7.7	8.3	8.7	8.7	8.0	10.3	13.5	17.2	19.2	20.3	21.8	20.0	18.1	18.9	15.0	9.6	6.0	5.1	5.2	6.5	6.2	6.2	

# SUMMARY OF METEOROLOGICAL OBSERVATIONS

## HOURLY DATA

APRIL 1967

Exposure		Monthly Means of Relative Humidity by Hour ( % )																								Monthly Summary				
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No of Obs.	M.in.	Mean	Max.	
Albrook (Forest site)	4	87	88	90	90	90	91	88	80	69	65	64	64	64	67	69	70	73	77	81	82	85	86	86	87	692	49	79	97	
	28.5 m	This level was not instrumented for relative humidity at this time																												
	26.5 m	90	91	91	92	92	92	89	82	72	67	65	66	65	66	70	71	74	78	83	85	87	87	88	88	717	49	80	98	
	13.5 m	91	91	92	93	93	93	93	88	79	73	71	69	68	69	73	74	75	78	82	84	87	88	89	89	719	53	83	99	
	8.0 m	This level was not instrumented for relative humidity at this time																												
	4.0 m	94	94	94	95	96	96	95	90	80	74	73	71	69	70	77	76	80	83	86	89	90	91	91	92	93	711	48	85	100
	2.0 m	94	95	95	95	96	96	96	91	82	76	74	71	70	70	78	77	80	84	87	90	90	91	91	93	94	712	44	86	100
	1.0 m	94	94	95	95	95	95	96	93	84	78	74	71	72	73	77	77	80	84	87	89	90	91	91	93	93	701	51	86	100
	0.5 m	93	94	94	94	95	95	95	92	86	81	76	72	72	72	78	78	81	84	87	89	90	91	91	93	93	719	48	86	100

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46.0 m	87	88	88	89	90	89	87	80	74	68	65	63	64	64	66	68	72	76	80	82	84	85	86	87	720	46	78	97	
28.5 m	This level was not instrumented for relative humidity at this time																												
26.5 m	88	88	89	90	90	90	37	79	72	67	63	61	64	64	65	67	72	76	79	82	83	85	86	87	720	43	78	98	
13.5 m	88	89	90	91	91	91	88	79	72	66	62	61	63	63	64	66	71	76	79	82	84	85	86	87	720	41	78	99	
8.0 m	This level was not instrumented for relative humidity at this time																												
4.0 m	89	90	91	92	92	92	88	78	70	65	61	61	62	62	62	64	71	75	79	82	84	86	87	88	717	44	78	100	
2.0 m	90	91	92	93	93	93	89	78	70	64	62	61	62	62	62	64	72	77	81	83	85	87	88	89	716	44	79	100	
1.0 m	90	91	91	92	92	92	90	80	71	64	61	60	62	62	63	66	72	78	82	85	87	88	89	90	720	43	79	99	
0.5 m	90	91	91	92	92	92	91	81	72	65	61	60	63	63	65	67	73	79	83	85	87	88	89	90	719	42	80	100	

SUMMARY OF METEOROLOGICAL OBSERVATIONS  
 HOURLY DATA  
 APRIL 1967

Exposure		Monthly Ranges of Relative Humidity by Hour (%)																								Monthly Summary*	
Site	Level	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	46.0 m	19	15	16	17	14	17	17	26	38	37	39	45	46	43	44	46	37	39	31	34	26	23	21	19		
	28.5 m							This level was not instrumented for relative humidity at this time																			
	26.5 m	16	16	14	15	13	17	18	26	36	37	40	46	47	44	45	49	41	36	23	22	20	19	17	16		
	13.5 m	16	16	13	12	12	13	15	20	27	35	37	42	45	44	44	46	41	37	30	29	26	24	21	20		
	8.0 m							This level was not instrumented for relative humidity at this time																			
Albrook (Forest site)	4.0 m	16	14	14	16	14	16	15	22	30	38	42	46	49	51	49	49	40	35	28	26	23	20	15	17		
	2.0 m	14	14	15	15	13	15	12	20	29	37	39	47	48	52	49	48	41	36	28	24	23	20	15	15		
	1.0 m	12	11	11	10	12	12	10	17	29	33	39	45	47	48	47	46	39	33	25	20	18	15	11	11		
	0.5 m	17	19	17	15	16	16	17	19	28	34	38	46	45	51	47	44	40	33	27	25	22	17	15	18		

\* % monthly summary  
 was computed for  
 the ranges.

Chiva Chiva (Open site)	46.0 m	16	14	16	13	14	20	14	22	30	36	41	43	48	50	46	45	44	38	30	24	20	19	20	18		
	28.5 m							This level was not instrumented for relative humidity at this time																			
	26.5 m	16	15	16	14	16	20	15	26	31	33	37	44	48	54	48	47	49	37	30	26	21	20	22	18		
	13.5 m	16	15	18	15	17	21	15	25	32	36	39	47	52	57	51	50	50	39	31	27	22	22	23	19		
	8.0 m							This level was not instrumented for relative humidity at this time																			
Chiva Chiva (Open site)	4.0 m	17	17	19	17	20	19	20	29	39	38	42	47	53	55	52	50	43	39	32	28	22	24	27	22		
	2.0 m	16	17	18	15	19	18	18	28	36	39	43	49	52	55	50	50	44	35	27	26	21	21	22	19		
	1.0 m	13	14	14	13	14	14	14	27	34	38	44	49	52	55	50	52	47	41	31	24	21	18	10	14		
	0.5 m	14	12	16	11	19	13	17	30	34	44	53	57	57	52	49	49	42	34	28	23	21	19	20	16		



# SUMMARY OF METEOROLOGICAL OBSERVATIONS HOURLY DATA

APRIL 1967

Exposure		Monthly Ranges <sup>2</sup> of other Elements by Hour																								Monthly Summary*	
Site	Code <sup>1</sup>	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
Albrook (Forest site)	WB (4.0 m)	4.9	5.2	5.7	6.5	6.7	7.6	7.3	4.4	3.8	4.6	5.9	5.3	5.4	5.8	5.9	6.3	5.0	5.2	4.0	4.6	5.4	5.0	4.1	4.1		
	WB (2.0 m)	4.9	4.9	5.7	6.5	6.9	7.8	7.2	4.2	3.6	4.0	5.4	5.6	5.2	4.8	5.0	5.7	4.8	5.2	4.2	4.3	4.9	5.0	3.6	4.0		
	WB (0.5 m)	4.6	4.9	5.5	6.1	6.9	7.3	7.8	5.4	3.9	4.4	4.3	5.6	6.3	7.3	7.5	7.2	4.4	4.8	4.2	4.1	4.0	3.6	3.4	3.9		
	BP	.175	.160	.165	.160	.165	.170	.170	.180	.145	.155	.185	.180	.175	.170	.170	1.85	.180	.190	.175	.165	.175	.170	.175	.185		
	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.07	0.08	0.44	1.02	0.33	1.20	0.45	0.00	0.15	0.00	0.00	0.00	0.00	0.00		
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.80	0.17	0.82	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.11	0.74	0.28	1.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.36	0.90	0.24	1.74	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

\* No monthly summary was computed for the ranges.

Chiva Chiva (Open site)	WB (4.0 m)	5.0	5.1	5.0	5.9	5.7	6.8	5.2	4.6	4.1	4.1	6.0	5.7	6.6	4.6	5.7	4.9	7.0	4.7	3.8	4.2	3.9	3.3	3.7	4.0		
	WB (2.0 m)	4.8	4.8	5.0	6.1	5.9	6.5	5.0	4.3	3.9	3.5	4.8	4.4	4.7	4.8	4.7	4.4	5.2	4.4	3.3	3.7	3.5	3.0	3.8	4.1		
	WB (0.5 m)	5.1	5.0	5.0	6.1	6.8	7.1	6.1	4.7	3.8	4.4	4.7	4.5	4.1	4.5	4.5	5.1	4.2	4.3	4.6	3.9	3.7	3.7	3.3	4.0		
	BP	.165	.165	.155	.160	.175	.175	.170	.180	.155	.160	.160	.175	.170	.170	.160	.185	.175	.168	.170	.160	.170	.165	.175	.170		
	P1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.10	0.15	0.03	0.24	0.03	1.03	0.79	0.04	0.00	0.00	0.00	0.00	0.00	0.00		
	P2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	P4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

WB - Wet bulb temperature (°F)  
BP - Barometric pressure (in. of Hg minus 29.0)

P1 - Precipitation at 1.0 m. in open area (in.)  
P2 - Precipitation at 46.0 m. above canopy (in.)  
P3 - Precipitation under drip canopy (in.)  
P4 - Precipitation under open canopy (in.)

<sup>2</sup> Monthly ranges of precipitation are computed for precipitation days.

# SUMMARY OF METEOROLOGICAL OBSERVATIONS

## HOURLY DATA

### APRIL 1967

[illegible]

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46.0 m	7	7	7	6	6	5	6	7	8	9	10	12	12	11	11	11	12	10	9	10	8	7	8	7	699	0	9	21								
28.5 m								This level was not instrumented for wind speed at this time																												
26.5 m	5	5	5	5	4	4	4	6	7	8	9	11	11	10	11	10	11	9	8	8	6	6	5	6	5	587	0	7	21							
13.5 m	2	2	3	3	2	2	2	4	6	5	7	9	9	7	8	9	6	6	6	6	4	4	3	3	674	0	5	20								
8.0 m								This level was not instrumented for wind speed at this time																												
4.0 m	3	3	3	3	2	2	2	4	5	6	6	8	8	7	8	8	8	6	5	5	4	3	4	3	699	0	5	16								
2.0 m	1	1	1	1	1	1	1	2	4	4	5	6	6	5	6	6	5	4	3	3	2	2	1	719	0	3	16									
1.0 m								This level was not instrumented for wind speed at this time																												
0.5 m								This level was not instrumented for wind speed at this time																												

## SUMMARY OF METEOROLOGICAL OBSERVATIONS

### HOURLY DATA

APRIL 1967

Exposure	Site	Level	Monthly Ranges of Wind Speed by Hour. (miles/hr.)																								Monthly Summary*
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Albrook (Forest site)		46.0 m	8	8	8	10	8	8	3	8	12	15	13	12	13	18	15	17	16	13	12	12	10	8	9	8	
		28.5 m								This level was not instrumented for wind speed at this time																	
		26.5 m	5	6	5	5	5	4	4	6	6	8	8	7	8	9	10	9	8	7	6	5	5	5	6	5	
		13.5 m								This level was not instrumented for wind speed at this time																	
		8.0 m								This level was not instrumented for wind speed at this time																	
		4.0 m	3	3	3	3	4	3	1	1	3	2	3	5	3	4	3	2	3	2	3	2	1	2	3	2	
	2.0 m								This level was not instrumented for wind speed at this time																		
	1.0 m								This level was not instrumented for wind speed at this time																		
	0.5 m								This level was not instrumented for wind speed at this time																		

\* No monthly summary was computed for the ranges.

[illegible]

ALBROOK (Forest site) APRIL 1967

Relative Frequencies * of Wind Directions by Hour at 46.0 m. ( % )																								
Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6.7			3.3			3.3		20.0	26.7	10.0	16.7	17.2	17.2	13.3	3.3	10.0		6.7		3.3	3.3	3.3	
NNE					3.3	3.3			3.3		10.0			3.4	6.7		3.3	3.3						
NE			3.3		3.3		3.3		3.3	6.7		3.3	3.4	6.9	3.3	3.3					3.3		3.3	
ENE									3.3	3.3	3.3	6.7						3.3				3.3		
E										3.3			10.3	6.9	3.3									
ESE				3.3						6.7	3.3		3.4	3.4	3.3									
SE								3.3	10.0		3.3	16.7	10.3		3.3	6.7	3.3							
SSE									6.7		13.3	6.7	10.3	6.9	6.7	3.3		3.3						
S							3.3		3.3	10.0	3.3	6.7	3.4	10.3	10.0		6.7	3.3	3.3					
SSW									3.3	3.3						3.3	3.3							
SW											3.3		3.4	3.4										
WSW	6.7	10.0	20.0	20.0	10.0	16.7	16.7	26.7	3.3	6.7	6.7	3.3	6.9	3.4	3.3	3.3		13.3	3.3	3.3	3.3	10.0	5.7	16.7
W	33.3	53.3	43.3	40.0	46.7	36.7	43.3	33.3	10.0	3.3	3.3	13.3			3.3	3.3	13.3	10.0	40.0	53.3	43.3	46.7	36.7	36.7
WNW	33.3	10.0	10.0	13.3	10.0	3.3	6.7	6.7	3.3	10.0	10.0	6.7	3.4	3.4	6.7		3.3	16.7	13.3	6.7	26.7	16.7	20.0	6.7
NW	6.7	6.7			6.7		3.3	6.7	10.0	10.0	10.0	3.3	10.3	24.0	20.0	23.3	20.0	26.7	16.7	23.3	3.3	3.3	6.7	23.3
NNW	3.3					6.7	3.3		13.3	3.3	16.7	16.7	17.2	6.9	10.0	36.7	16.7	13.3			6.7	3.3	6.7	
CALM	20.0	20.0	23.3	20.0	20.0	13.3	16.7	26.7	6.7	6.7	3.3			3.4	6.7	13.3	20.0	5.7	16.7	13.3	10.0	10.0	16.7	16.7

\* Note: Due to rounding, percentages totals do not equal 100%.



ALBROOK (Forest site) APRIL 1967

Relative Frequencies * of Wind Directions by Hour at 26.5 m. ( % )																								
Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		6.7			6.7			3.3	6.7	10.0	13.3	10.0	3.4	10.3	13.3	20.0	13.3	3.3	6.7	3.3	3.3	6.7		
NNE								3.3	10.0	3.3	3.3	10.0	6.9		6.7	6.7	3.3	3.3	6.7					
NE										3.3		10.0	6.9	10.3	6.7	3.3	3.3	3.3	3.3					
ENE								3.3	13.3	3.3	3.3			6.9	6.7	3.3		3.3						
E								6.7	10.0	13.3	3.3	3.3	20.6	3.4	10.0		10.0							
ESE									3.3			3.3				3.3	3.3			3.3				
SE								3.3			3.3	10.0	6.9		3.3	3.3		3.3						
SSE											10.0	3.3	10.3	3.4	3.3	3.3								
S								10.0	10.0	3.3	3.3	10.0	10.3	17.2	13.3	10.0	13.3		3.3					
SSW									3.3	13.3	3.3	3.3					3.3							
SW			3.3					3.3	3.3			6.7	3.4					3.3		6.7				
WSW			3.3					3.3	6.7	3.3	3.3	6.7	3.4					3.3	3.3				6.7	
W	16.7	20.0	13.3	20.0	16.7	3.3	13.3	16.7		6.7	6.7	6.7	3.4	6.9		6.7	3.3	6.7	6.7	3.3	13.3	6.7	20.0	20.0
WNW	20.0	20.0	16.7	13.3	6.7	30.0	20.0	30.0	6.7	6.7	10.0	6.7	6.9			3.3	6.7	16.7	16.7	23.3	26.7	33.3	36.7	30.0
NW	40.0	26.7	23.3	23.3	26.7	6.7	23.3	10.0	30.0	3.3	10.0	3.3	10.3	20.6	13.3	10.0	16.7	30.0	30.0	26.7	33.3	20.0	16.7	26.7
NNW	3.3	3.3	3.3		3.3	3.3		3.3	3.3	3.3	10.0	6.7	6.9	10.3	6.7	13.3	10.0	10.0	6.7	10.0	6.7	10.0		
CALM	20.0	23.3	36.7	43.3	46.7	46.7	40.0	23.3	10.0	10.0	6.7		23.3	10.3	16.7	13.3	13.3	13.3	16.7	23.3	16.7	23.3	20.0	23.3

\* Note: Due to rounding, percentage total, do not equal 100%.

ALBROOK (Forest site) APRIL 1967

Relative Frequencies * of Wind Directions by Hour at 4.0 m. (%)																								
Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	6.7	3.3		3.3		10.0		3.3		3.3	3.3				3.3	6.7	13.3	6.7	3.3	3.3	3.3			6.7
NNE							3.3		3.3		3.3	6.7	6.9	10.3					3.3	3.3		3.3	6.7	
NE	3.3		3.3					3.3	3.3	3.3	3.3	6.9			6.7	3.3	3.3					3.3		
ENE									6.7	3.3	3.3		3.4						6.7					
E									6.7	16.7	3.3	10.0	10.3	6.9	3.3	10.0								
ESE											3.3	16.7	6.9		6.7		3.3							
SE								3.3		3.3	3.3	3.3	13.7	3.4					3.3					
SSE								3.3	3.3	3.3	3.3		3.4	6.9		3.3						3.3		
S								13.3	6.7	13.3	20.0	23.3	17.2	10.3	10.0	10.0	13.3	6.7			3.3			
SSW								3.3		3.3	3.3	3.3					6.7							
SW									6.7	6.7	3.3	3.3	3.4	3.4						6.7	6.7	3.3	3.3	3.3
WSW						3.3			3.3	3.3	3.3		3.4	3.4					2.3	3.3	3.3			
W	3.3				3.3				6.7				3.4		3.3	3.3	3.3	3.3	3.3		6.7	3.3	10.0	
WNW	6.7	3.3	3.3	10.0	3.3	6.7	6.7				3.3			6.9	6.7			13.3	6.7	6.7		6.7	3.3	13.3
NW	10.0	10.0	13.3	6.7	6.7		10.0	3.3	3.3	3.3	3.3	3.3		3.4	3.3	6.7			3.3		6.7	3.3	10.0	10.0
NNW		3.3	3.3			3.3			3.3					3.4	6.7		6.7							3.3
CALM	70.0	80.0	76.7	80.0	86.7	76.7	80.0	66.7	50.0	36.7	36.7	30.0	20.6	41.7	50.0	56.7	50.0	70.0	66.7	76.7	70.0	73.3	66.7	63.3

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) APRIL 1967

Relative Frequencies * of Wind Directions by Hour at 46.0 m. ( % )																								
Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N	3.3	6.9		6.3	10.3	10.0	6.9	10.7	13.7	24.0	30.9	17.2	14.2	13.7	2.5	20.0	13.7	6.7	17.2	6.9	6.9	3.4	3.3	
NNE	6.7		6.7							10.3	13.7	10.3	7.2	3.4	10.7	3.3	3.4	6.7						
NE												3.4					3.4	3.3						
ENE					3.4				10.3	3.4		3.4		3.4	3.5			3.3	3.4	3.4	6.9			
E	3.3						3.4		3.4	3.4	3.4		7.2		3.5	3.3		3.3				3.4	3.3	
ESE									6.9	3.4	3.4	6.9	3.5											
SE				3.3					10.3	3.4	6.9		10.7	10.3	3.5	6.7	6.9			3.4				
SSE									3.4		6.9	7.2	6.9			3.3	3.4		3.4					
S						6.7		3.5	6.9	3.4	6.9	10.3	3.5	6.9	10.7		6.9	3.3	10.3					
SSW										6.9		3.4		3.4	3.5									
SW			3.3								3.4			3.4		3.3								6.9
WSW		6.9		6.7			3.4			6.9							3.4							
W	3.3	3.4	3.3	3.3	3.4	10.0	6.9	3.5		3.4	3.4		7.2					6.9	6.9	6.9	6.9	6.9	6.7	3.4
WNW	13.3	17.2	20.0	13.3	20.6	16.7	20.6	10.7	3.4	3.4	3.4	3.4	3.5	3.4		3.3	6.9	6.7		13.7	3.4		16.7	13.7
NW	40.0	37.8	40.0	50.0	54.9	33.3	48.1	50.0	3.7	13.7	10.3	17.2	14.2	6.9	21.4	30.0	13.7	13.3	20.6	30.9	34.3	44.6	33.3	58.4
NNW	30.0	27.5	26.7	20.0	6.9	23.3	10.3	21.4	27.5	13.7	13.7	17.2	21.4	37.8	39.3	26.7	37.8	50.0	37.8	41.2	41.2	41.2	36.7	17.2
CALM																		3.3						

\* Note: Due to rounding, per centage totals do not equal 100%.

CHIVA CHIVA (Open site) APRIL 1967

		Relative Frequencies * of Wind Directions by Hour at 26.5 m. ( % )																							
Dir.	Hr.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N		13.7	24.9	6.9	13.7	10.7	21.4	7.2	22.2	28.6	29.6	28.6	21.4	25.9	35.6	22.2	24.0	21.4	34.3	42.8	35.6	28.6	17.9	34.3	14.2
NNE		3.4	3.5	6.9	3.4	7.2	7.2	3.5	3.7	7.2	11.1	21.4	10.7		10.7	11.1	13.7	14.2	6.9	3.5	7.2	3.5	3.5		
NE		3.4			3.4			3.5		3.5	3.7	7.2	10.7	14.8	7.2	3.7	3.4	7.2	3.4	3.5	3.5				
ENE										7.2				3.7		7.4			6.9					3.4	
E		3.4		3.4							7.4	3.5	3.5	7.4	3.5				3.4	3.5		7.2	3.5		
E.E										3.5		3.5	7.2			3.7	6.9				3.5				
SE				6.9	3.4		3.5			14.2	3.7	10.7		11.1	10.7		3.4								
SSE											7.4	3.5	3.5	3.7	3.5	7.4		10.7							
S		3.4	3.5							3.5		3.5	10.7	3.7	10.7	7.4	3.4		3.4	7.2					
SSW							3.5				3.7	3.5	3.5												
SW					3.4				3.7		7.4	3.5	3.5			3.7	3.4	3.5							3.5
WSW			3.5		3.4		3.5	3.5				3.5													
W					3.4		3.5	7.2	3.7		7.4			3.7		3.7		3.5		3.5		7.2	10.3	3.5	
WNW		10.3	3.5	3.4	13.7	7.2	3.5	17.9	3.7	3.5		3.5		3.7				7.2	6.9	3.5		3.5			7.2
NW		20.6	17.9	17.2	20.6	46.3	21.4	17.9	25.9	14.2				3.7	7.2	3.7	10.3	7.2	3.4		17.9	21.4	14.2	13.7	23.6
NNW		37.8	32.1	41.2	27.5	21.4	24.9	28.6	29.6	14.2	18.5	3.5	24.9	18.5	10.7	25.9	27.5	24.9	24.0	28.6	28.6	32.1	37.0	37.8	42.8
CALM		3.4	10.7	13.7	3.4	7.2	7.2	10.7	7.4								3.4		6.9	3.5	3.5	3.5	3.5		

\* Note: Due to rounding, percentage totals do not equal 100%.

CHIVA CHIVA (Open site) APRIL 1967

Relative Frequencies * of Wind Directions by Hour at 4.0 m. ( % )																								
Dir.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	2.	23	24
N		6.9	6.7	6.7	17.2	6.7	6.9	10.7	24.0	6.9	30.9	20.6	17.9	13.7	10.7	16.7	13.7	13.3	6.9	6.9	10.3	13.7	13.3	13.7
NNE	3.3	13.7	13.3		3.4	13.3		3.5	3.4	3.4	13.7	10.3	3.5	3.4	3.5	6.7	13.7	6.7	3.4		3.4		3.3	3.4
NE	6.7			13.3		13.3		7.2	6.9	10.3	3.4	6.9	3.5	10.3	10.7	3.3	3.4	10.0	3.4	6.9	3.4		3.3	3.4
ENE	6.7	3.4	6.7	3.3	6.9		3.4		3.4	3.4				3.4		3.3		3.3			3.4			
E		3.4		3.3		3.3	3.4		3.4		3.4		7.2					3.3	3.4					
ESE									3.4		3.4	6.9	3.5		3.5	3.3								
SE			3.3	3.3						6.9	3.4		13.7			6.7		3.3						
SSE									10.3		3.4		14.2		3.5		6.9		3.4					
S							6.9	3.5	10.3	6.9	13.7	17.2	7.2	10.3	14.2	3.3	6.9		3.4					
SSW								3.5		13.7	3.4	3.4			3.5	3.3						3.4	3.3	3.4
SW				3.3			3.4			6.9	3.4						6.9					3.4		
WSW				3.3						3.4				3.4		3.3		3.3				3.4	3.3	3.4
W	3.3	3.4				3.3	10.3	7.2	3.4		3.4		7.2						6.9	3.4			3.3	
WNW	10.0	6.9	13.3	16.7	17.2	3.3	13.7	10.7	3.4					6.9		3.3	10.3	6.7		6.9	10.3	17.2	6.7	17.2
NW	50.0	34.3	43.3	36.7	27.5	16.7	30.9	32.1	17.2	20.6	3.4	24.0	21.4	17.2	14.2	20.3	10.3	10.0	20.6	30.9	34.3	17.2	40.0	37.8
NNW	16.7	20.6	10.0	3.3	13.7	26.7	6.9	17.9	10.3	17.2	10.3	10.3	14.2	17.2	35.6	26.7	27.5	36.7	48.1	41.2	34.3	4.2	20.0	10.3
CALM	3.3	6.9	3.3	6.7	13.7	13.3	13.7	3.5										3.3		3.4			3.3	6.9

\* Note: Due to rounding, percentage totals do not equal 100%.

# SUMMARY OF NON HOURLY DATA

APRIL 1967

Summary of Elements with Non-hourly Frequencies of Observation

Site	Element, Units and Exposure	Description	Number of Obs.	Minimum Value	Mean or Total Value	Maximum Value
Albrook (Forest site)	WBG T Index <sup>1</sup> (at 1.5 meters)	Index value	402	68.1	77.4	83.1
		Dry bulb temp.	402	68.2	80.3	92.5
		Wet bulb temp.	402	68.0	75.8	81.0
		Black bulb temp.	402	68.2	81.5	95.1
	Evaporation <sup>3</sup> (in. at 4 levels)	Piche (46.0 m)	29	0.024	14.660*	0.909
		Piche (26.5 m)	29	0.024	9.253*	0.586
		Piche (13.5 m)	28	0.012	4.613*	0.293
		Piche ( 0.5 m)	26	0.006	3.123*	0.244
	Precipitation from Raingauge Network <sup>2</sup> (in. at 1.0 meters)	Gauge # 1	20	0.01	6.09*	2.25
		Gauge # 2	20	0.01	5.97*	1.41
		Gauge # 3	19	0.01	6.28*	1.67
		Gauge # 4	19	0.01	5.04*	1.20
		Gauge # 5	19	0.01	5.93*	1.47
		Gauge # 6	18	0.01	5.44*	1.39
		Gauge # 7	20	0.01	4.72*	0.96
		Gauge # 8	18	0.01	4.98*	1.09
	Stem Flow <sup>2</sup> (in. at 2.0 meters)	Small tree	16	0.01	5.70*	1.37
		Medium tree	16	0.01	4.76*	1.00
		Large tree	12	0.01	46.96*	19.75
Chiva Chiva (Open site)	WBG T Index <sup>1</sup> (at 1.5 meters)	Index value	412	67.0	80.1	88.5
		Dry bulb temp.	412	67.5	83.8	97.0
		Wet bulb temp.	412	67.0	76.0	80.1
		Black bulb temp.	412	66.7	92.6	120.8
	Evaporation <sup>3</sup> (in. at 0.5 meters)	Piche	30	0.024	12.673*	0.744
		Pan	27	0.037	5.711*	0.349
	Minimum Grass temp <sup>3</sup> (°F at grass tips)	None	27	65.3	70.0	73.8

- 1 - Hourly observations between 0600 and 1900 hours inclusive  
 2 - Six hourly observations  
 3 - Daily observations

\*Total Values

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<p>This report contains detailed microclimatic data for April 1967 from specific sites in the Panama Canal Zone and vicinity. The data are presented in tabular form, summarized for hourly and/or daily observations from surface to 46-meter levels. Elements listed are: temperature, pressure, precipitation, wind speed and direction, relative humidity, and evaporation.</p>			

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14.

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## LINK B

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Climate  
Microclimatology  
Tropic Environment  
Humid Tropics  
Panama Canal Zone Microclimatology  
Data Base

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